THE "EXTRA-SOLAR GIANT PLANETS" ARE BROWN DWARFS

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After an M, K, G, or F star forms, it magnetically compresses the infall dregs to produce a close-in brown dwarf.

A new M, K, G, or F star is rapidly rotating and magnetic. It rotates at, say, 60 km/s, or once per day. Figure 1 shows the present solar magnetic field when rotation has decayed to 2 km/s or once a month. Figure 2 shows the same view of the solar field 4.5 billion years ago. The lightly-wound field now originally had many windings between the star and the "Mercury" wall. Figures 3 and 4 show the side views. Weak jets of rejected material blow from the poles. The remaining structure is a magnetic compressor. Neutral material is drawn toward the star by gravity from above and below the disk. These are only the dregs of the cloud as the star formation process shuts down. Flares, reconnections, etc. ionize the incoming neutral material so that it is slowed and compressed and caught by the field lines. It is also compressed from behind by additional infall. Flares hammer and distort the field lines to orders of magnitude greater effect than now, Figure 5. These distortions prevent material from falling inward. The infall forms a highly compressed, self-gravitating double torus above and below the equator. The tori are very unstable. A large flare triggers their rapid collapse into one or two brown dwarfs orbiting inside the orbit of "Mercury". One brown dwarf can have a stable orbit. If there are two brown dwarfs, one or both are ejected to wider orbits or are accreted by the star. If the dregs are insufficient to form a brown dwarf, they are eventually eroded away by the wind.

The brown dwarf or dwarfs have low abundances because the magnetic field separates elements with high first ionization potential that are neutral from elements with low first ionization potential that are ionized. Here is the list of elements with their ionization potentials in cm^{-1} that are not ionized by Lyman α or β: H 109678, He 198310, N 117225, O 109837, F 140524, Ne 173929, Cl 104591, Ar 127109, Kr 112914. As neutrals, these elements pass deep into the magnetic trap until they are suddenly ionized by flares. They are unable to get out and they join the trapped plasma that eventually forms a brown dwarf.

All other elements have low ionization potentials so are ionized by the photospheric and chromospheric radiation from the protostar. If they fall toward the protostar, they spiral on the divergent magnetic field lines and are expelled far from the star itself. The easily ionized elements have low abundances in the final brown dwarf.

As the surface of the brown dwarf cools, molecules form such as H_2, NH, OH, HF, HCl, N_2, O_2, NO, H_2O, O_3, N_2O, NO_2, H_2^+, H_3^+, dimers, etc.

If the brown dwarf is accreted by the star, the star will have reduced apparent abundances depending on the relative masses of the brown dwarf and of the convective zone of the star.

Of course, the total abundances integrated through the whole star in nearby Population I stars less than, say, 4 billion years old, are equal to, or greater than, solar.

The bodies that are now being discovered called "extra-solar giant planets" are not planets but brown dwarfs. Brown dwarfs formed by other mechanisms could have high abundances.

I hope that someone capable of computing this scenario will investigate it in detail.

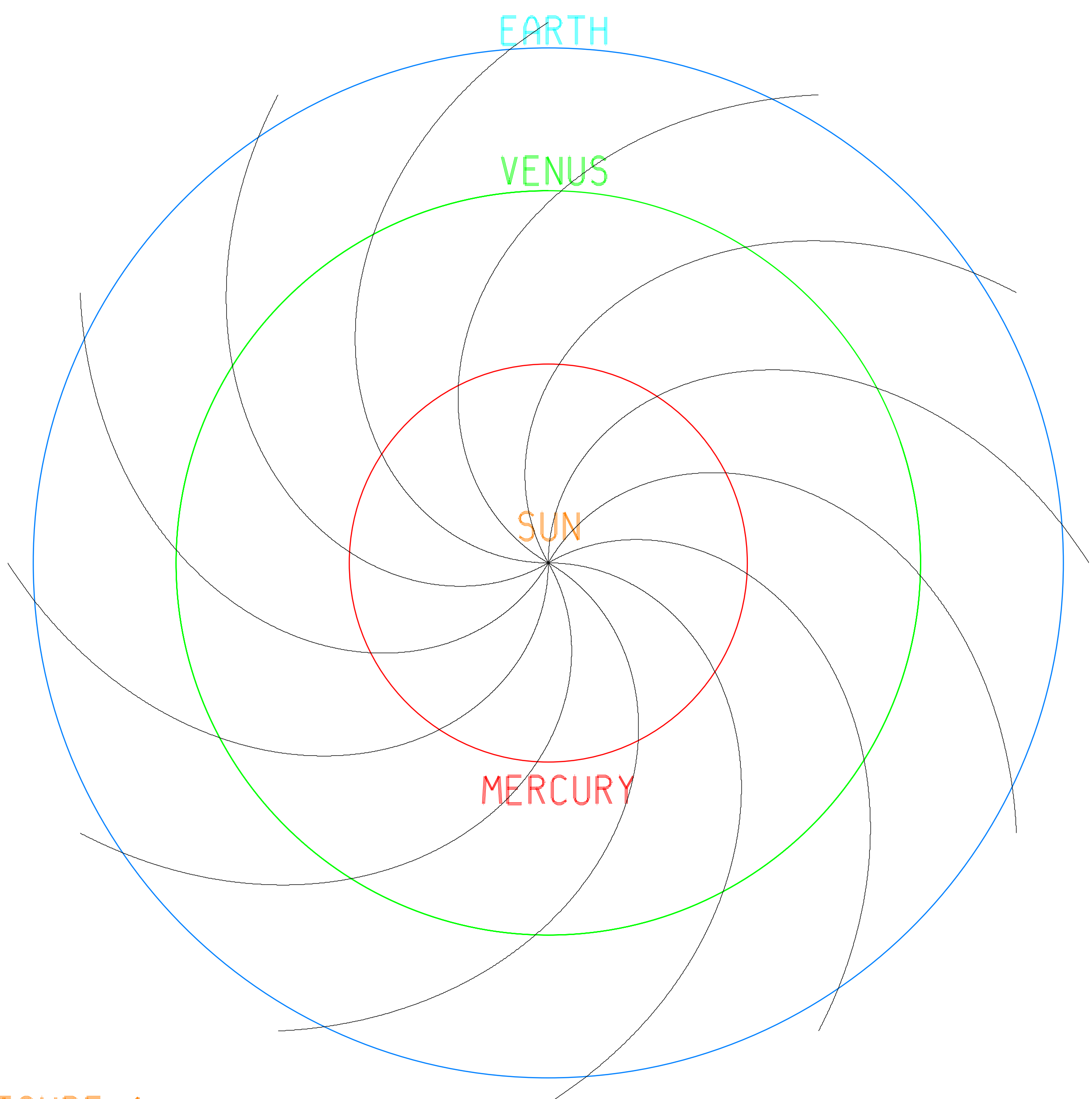

FIGURE 1
SCHEMATIC VIEW OF THE SOLAR EQUATORIAL MAGNETIC FIELD
FOR SLOW ROTATION

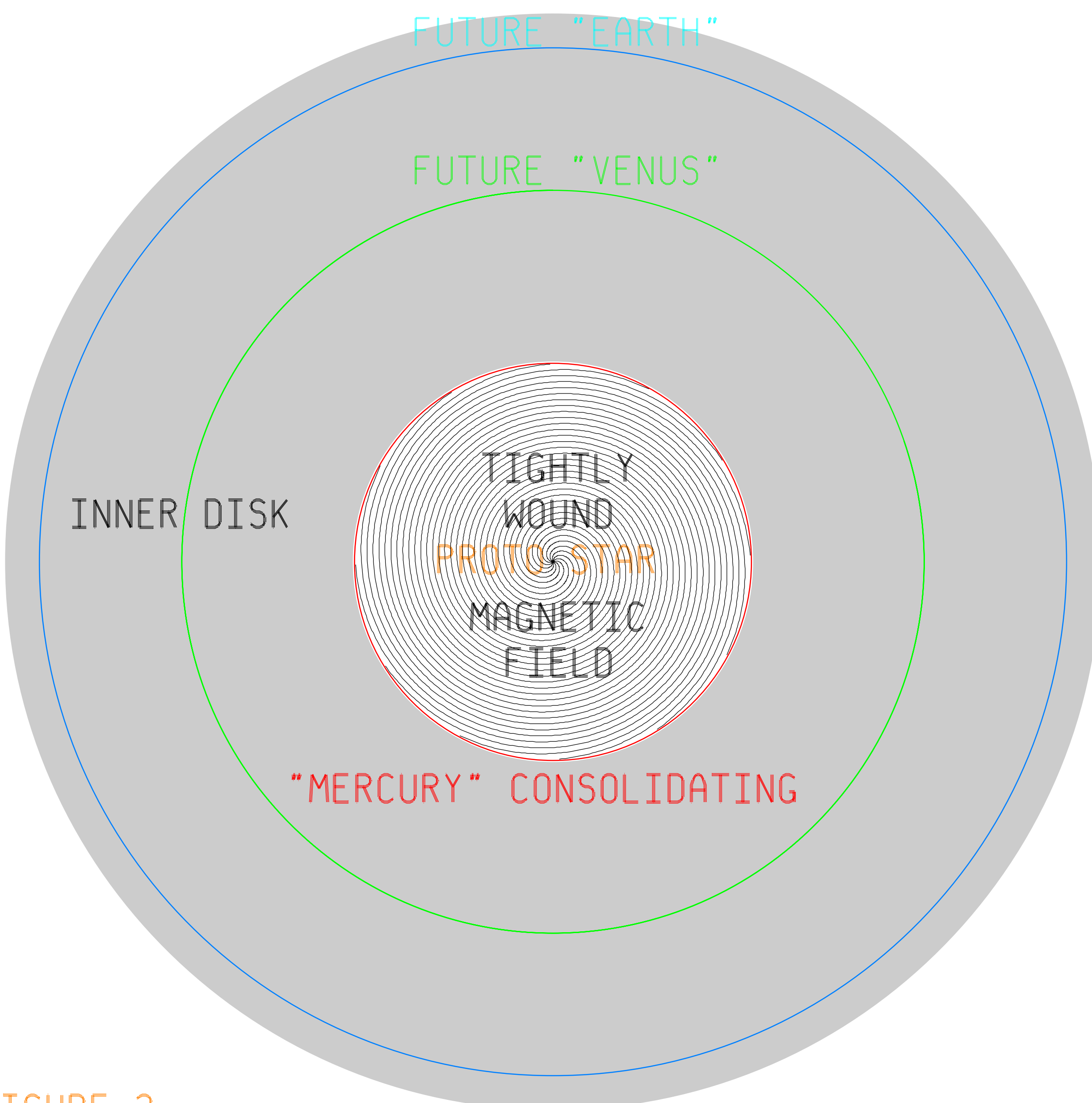

FIGURE 2
AN EQUATORIAL CUT THROUGH THE INNER PROTO-SOLAR SYSTEM SHOWING SCHEMATICALLY THE MAGNETIC FIELD FOR FAST ROTATION

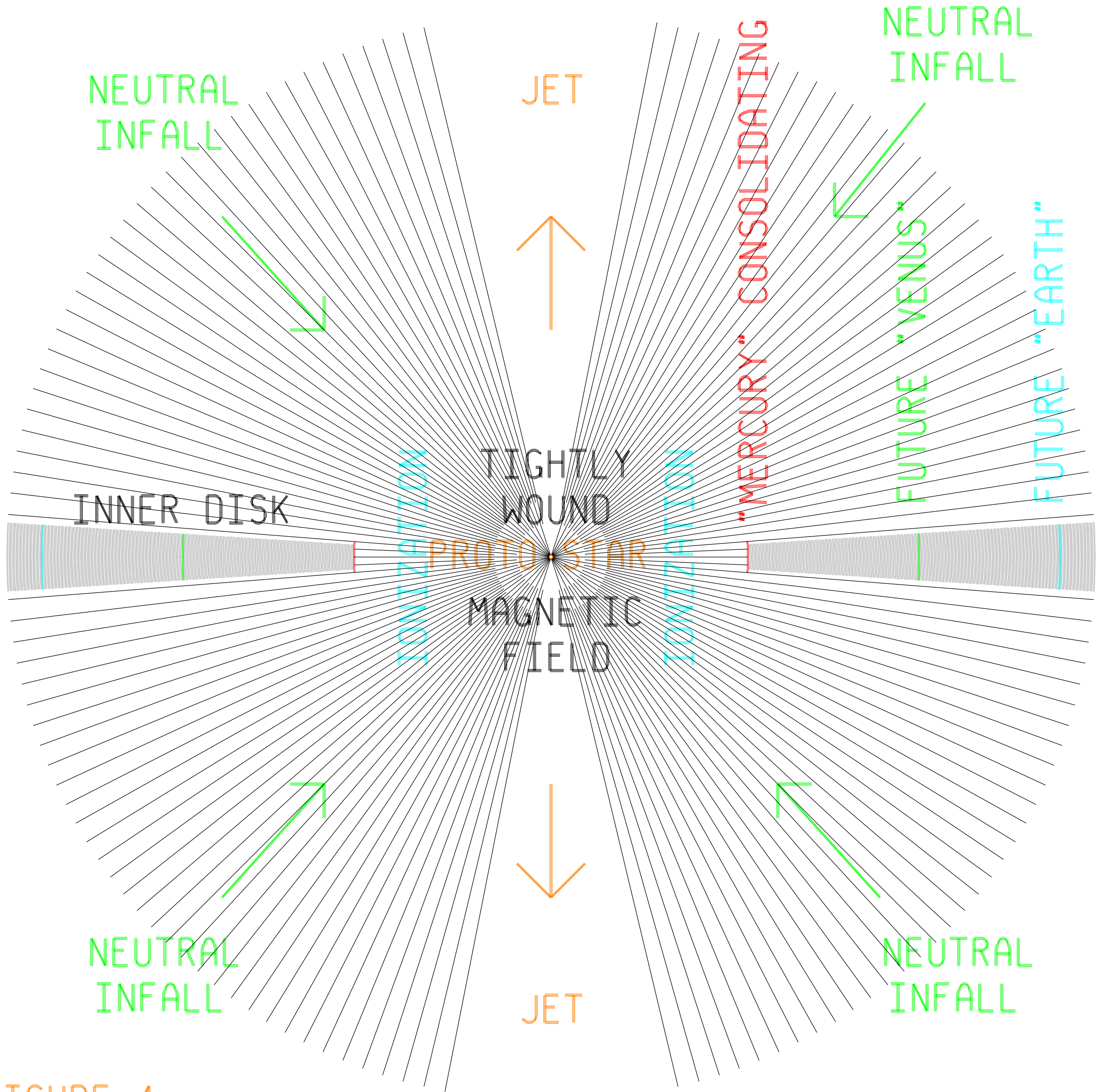

FIGURE 4
A PERPENDICULAR CUT THROUGH THE INNER PROTO-SOLAR SYSTEM SHOWING SCHEMATICALLY THE MAGNETIC FIELD FOR FAST ROTATION

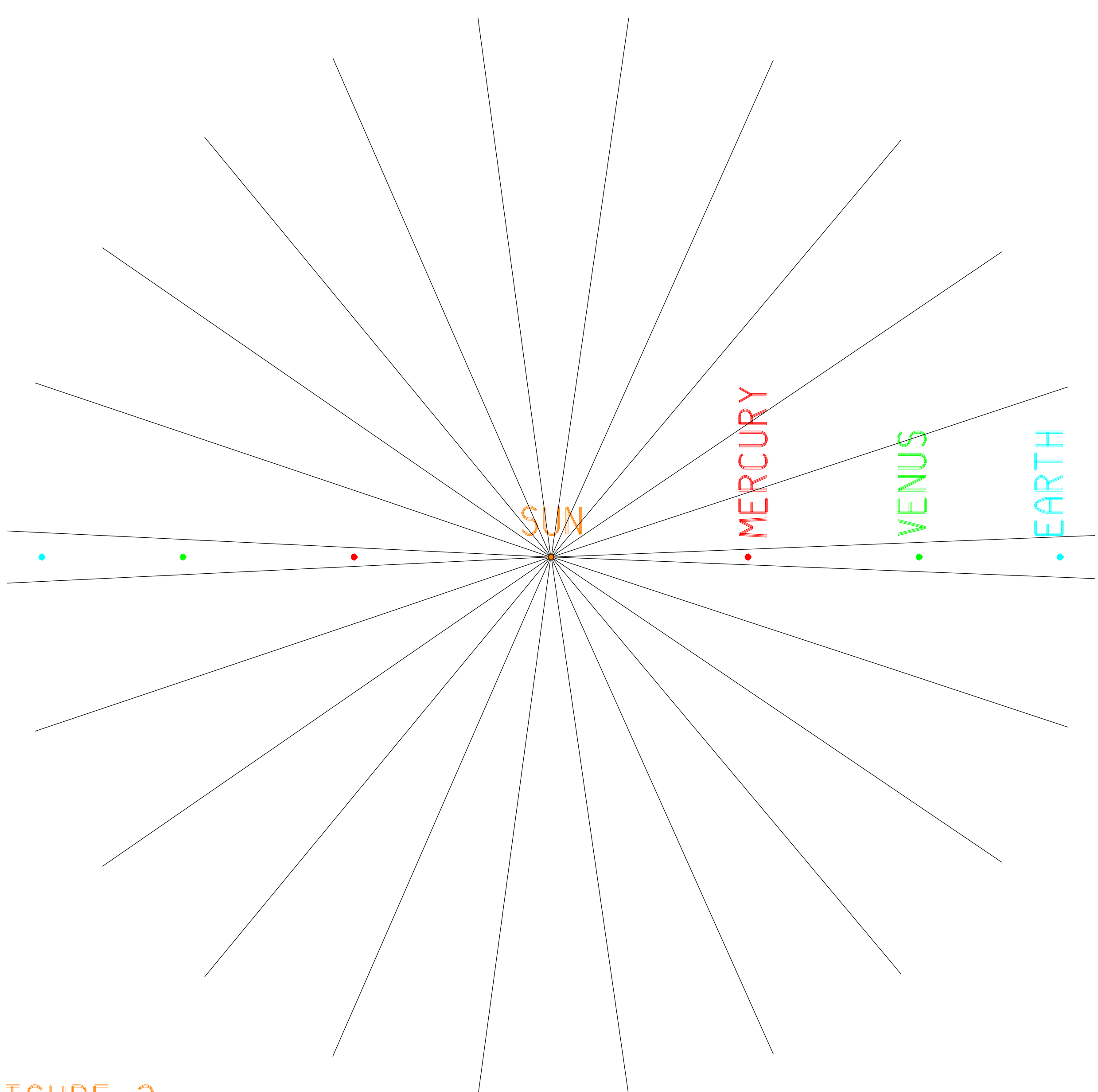

FIGURE 3
A PERPENDICULAR CUT THROUGH THE INNER SOLAR SYSTEM SHOWING SCHEMATICALLY THE SOLAR MAGNETIC FIELD FOR SLOW ROTATION

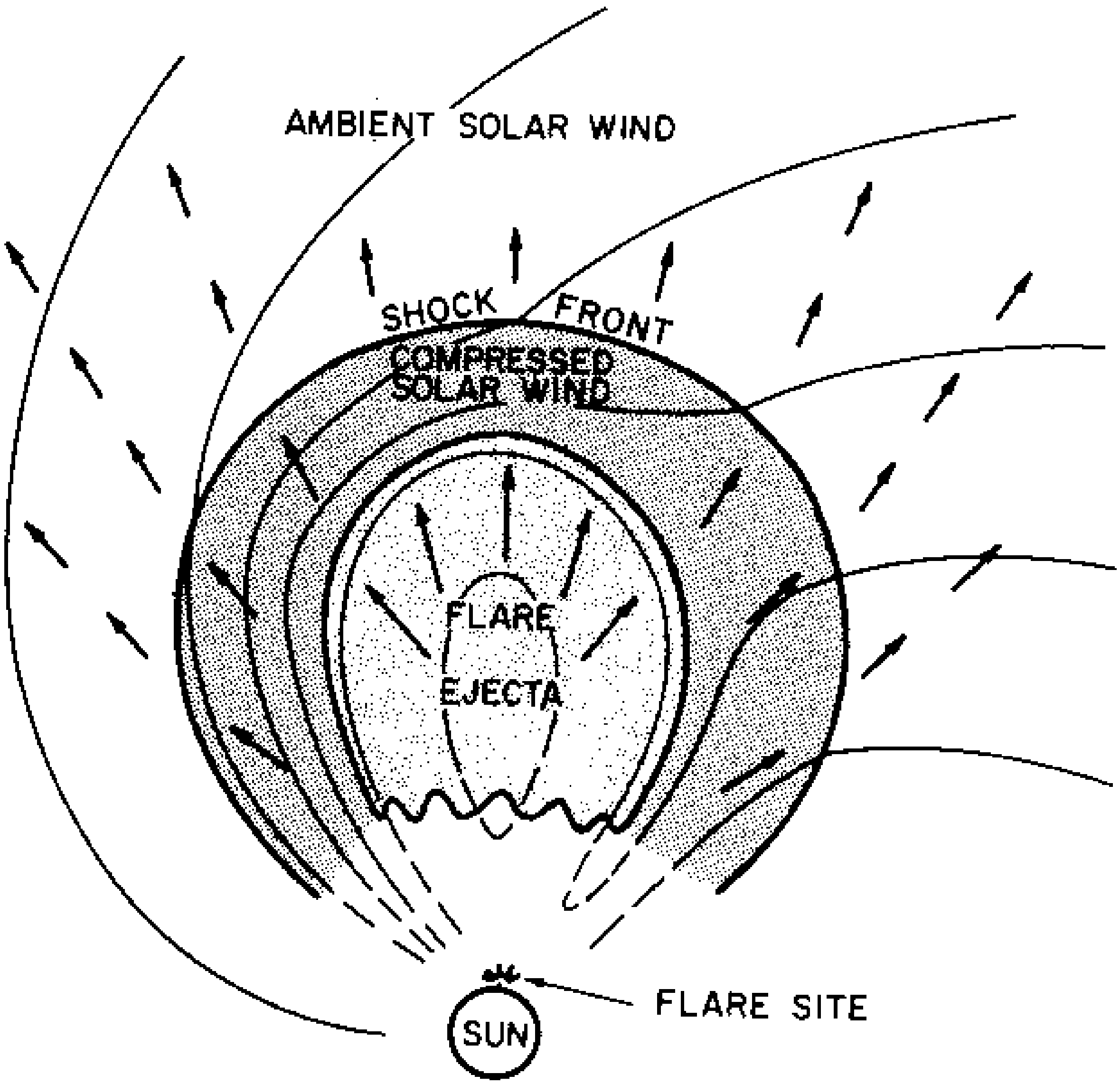

FIGURE 5
SCHEMATIC VIEW OF A FLARE PROPAGATING IN FIGURE 1
ARROWS INDICATE PLASMA FLOW VELOCITY. FROM
HUNDHOUSEN, A. J., "CORONAL EXPANSION AND SOLAR WIND",
NEW YORK: SPRINGER-VERLAG, 1972